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Selected US specifications from IPC sub-class
F16C

(54) **A sealing assembly for interposition between two members in relative rotation operable to permit detection of the speed of relative rotation between them, and a bearing for supporting a vehicle wheel, provided therewith**

(57) A sealing assembly 7 comprises two rigid connectable screens 8,9 one of which is provided with an elastomeric sealing element 23 cooperating with the other screen 8, one of the screens being fixedly provided with a sensor 22 (magnetic, inductive, capacitive) whilst the other is provided fixedly with a ferromagnetic reference element 19 provided with a plurality of depressions 18 at regular intervals in a ring, for example a toothed element. The screen 8 provided with the toothed element is securely fitted onto a rotating member the speed of which it is desired to measure, for example on a flanged ring 2 of a rolling element bearing fixed securely to the wheel of a vehicle, whilst the other screen 9 is fitted onto the other member, for example the other ring 3 of the said bearing, in such a way as to define with the said members a chamber 24 housing the sensor 22 and the ferromagnetic element and closed in a fluid tight manner against the exterior by the elastomeric element 23.

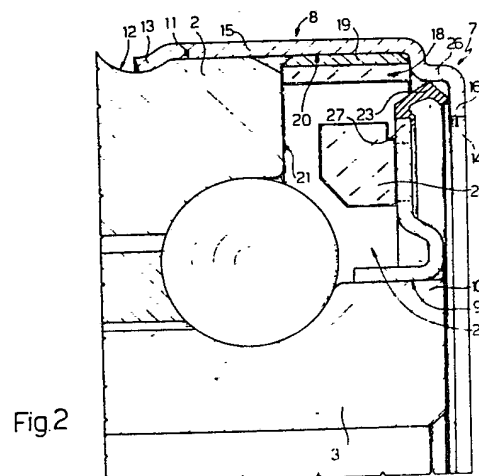


Fig.2

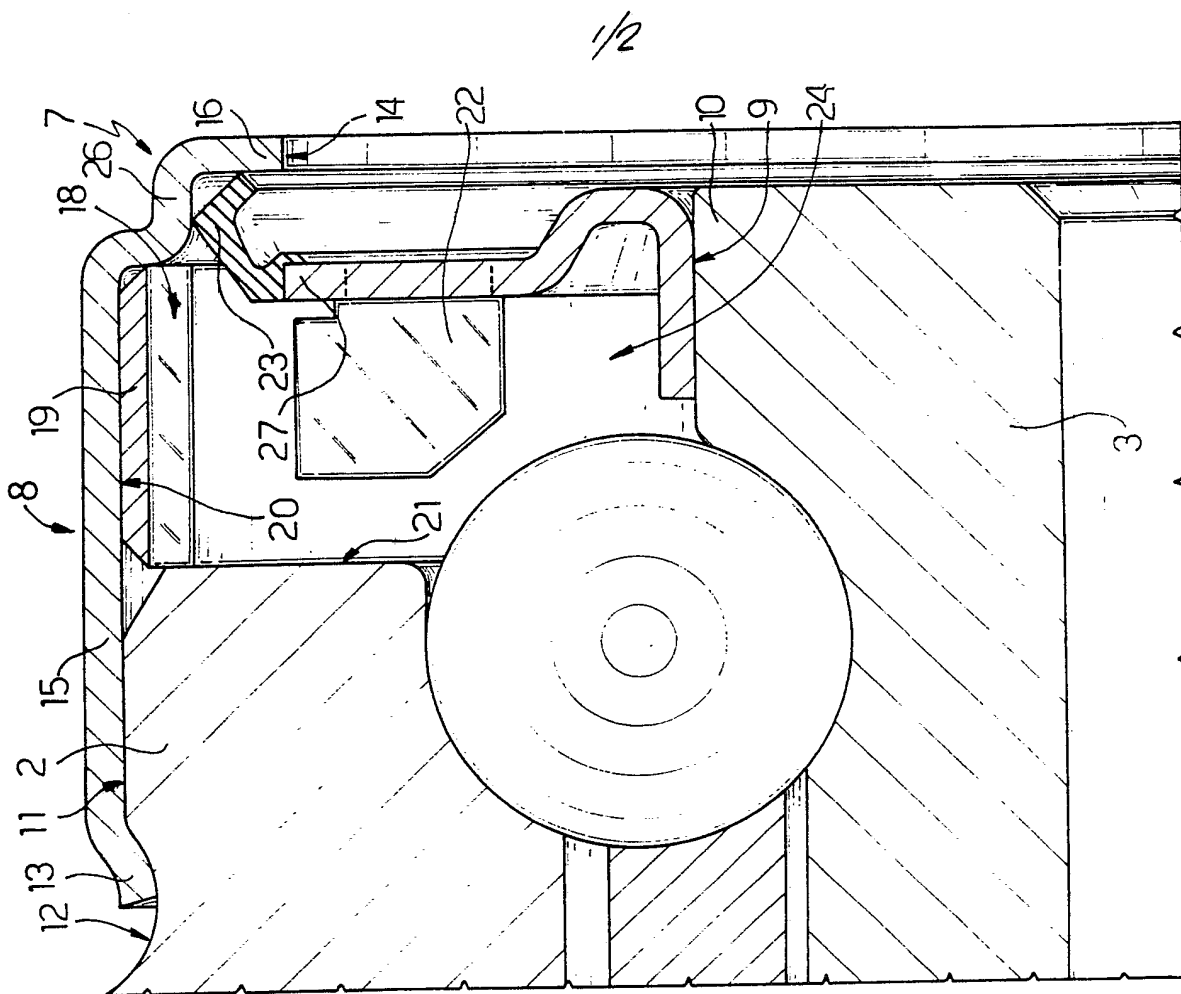


Fig. 2

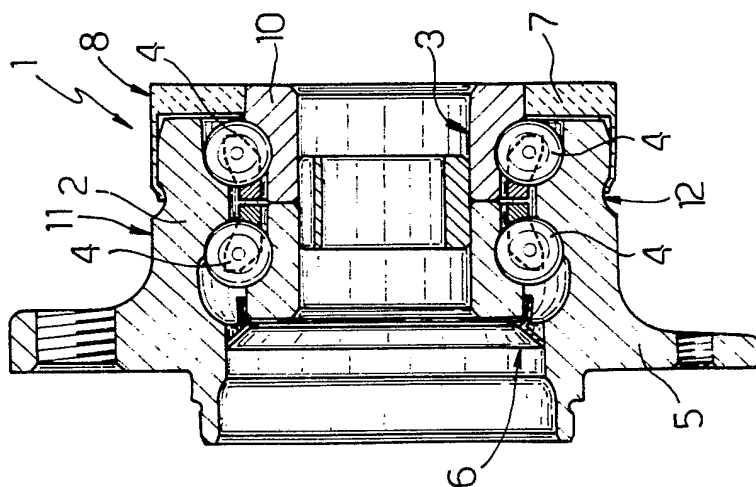
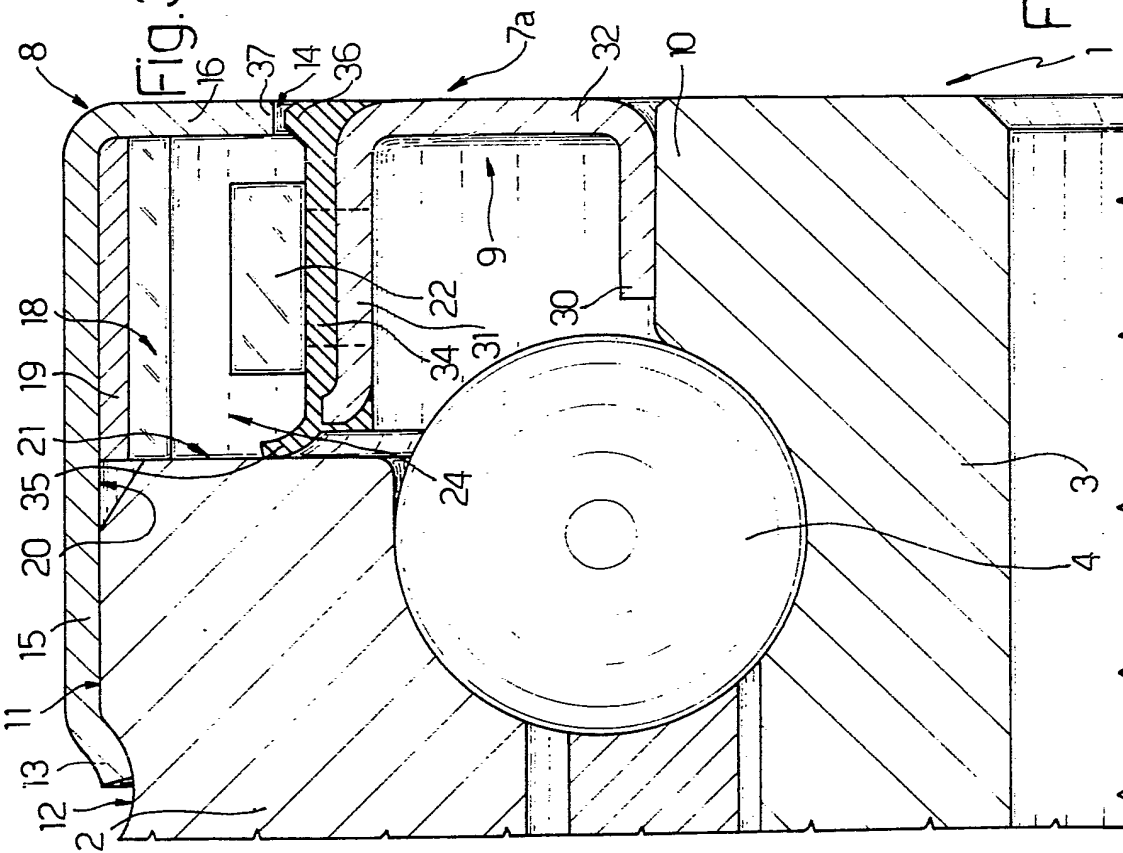
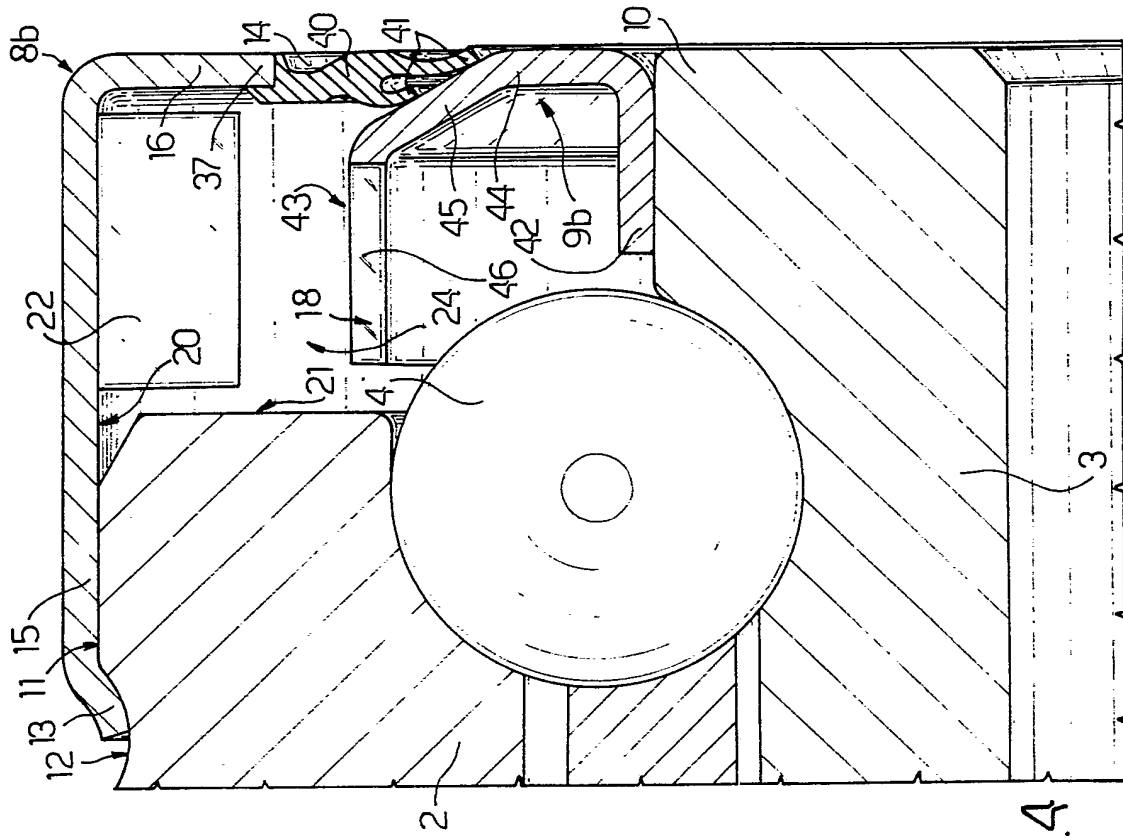


Fig. 1



A SEALING ASSEMBLY FOR INTERPOSITION BETWEEN TWO MEMBERS
IN RELATIVE ROTATION OPERABLE TO PERMIT DETECTION OF THE
SPEED OF RELATIVE ROTATION BETWEEN THEM, AND A BEARING
FOR SUPPORTING A VEHICLE WHEEL, PROVIDED THEREWITH

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The present invention relates to a sealing assembly which
can be interposed between two members in relative
rotation, for example the rings of a rolling element
bearing, and which can permit the speed of relative
10 rotation between them to be detected; further the
invention also relates to a rolling element bearing for
supporting the wheel of a vehicle provided with the said
sealing assembly.

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It is known that currently special control circuits of
the type known as ABS are installed for the purpose of
preventing locking of the wheels of the vehicle during
braking; these circuits consist, as is known, of an
hydraulic operative part acting by means of valves on the
20 braking circuit, and an electronic control part able to
cause the operative part to intervene when a differential
variation in the speed of rotation of the wheels of each
axle of the vehicle greater than a predetermined
threshold is detected; these speed variations are
25 detected by an appropriate known circuit making use of
electromagnetic sensors, at least one for each wheel of

the vehicle, each of which emits a pulse signal proportional to the speed of rotation of the wheel controlled by it; this pulse signal is obtained in the majority of cases by mounting, usually on the wheel support bearing, a toothed element known in the art as a "phonic wheel" or "impulse ring"; this element essentially comprises a flange of ferromagnetic material fixed for rotation with the wheel and provided with a toothed ring in correspondence with which the sensor is mounted; during rotation of the wheel, therefore, the alternation past the sensor of solid parts constituted by the teeth and voids constituted by the spaces between the teeth causes a periodic variation in the air gap between the flange and sensor and, therefore, a periodic variation in the magnetic field with consequent generation by the sensor of a periodic oscillating signal the frequency of which is proportional to the speed of rotation of the wheel.

One disadvantage of the above described detection system lies in the large dimensions and weight of the phonic wheel and in its cost which is also rather high. Above all, however, the system described involves the disadvantage of becoming unreliable after a relatively short period of use in that ferromagnetic dust produced by wear of the braking seals become mixed with road mud

which comes into contact with the vehicle suspension in operation, filling the spaces between the teeth of the phonic wheel and therefore causing a fall or attenuation in the signal produced by the sensor for which reason it becomes necessary periodically to renew the efficiency of the system by frequently washing the wheel-suspension units.

The object of the invention is that of providing a sealing assembly which can be fixed to a rotating member, in particular to a ring of a bearing for supporting a vehicle wheel, and operable simultaneously to exert a sealing action and to allow detection of the angular velocity of the rotating member to which it is fixed by means of a system for generating magnetic pulses entirely similar to that currently in use in ABS systems so as to be usable in place of the phonic wheel and the sensors currently used in this system.

The said object is achieved by the invention, which relates to a sealing assembly for interposition between two relatively rotatable members, in particular between the rings of a roller element bearing for supporting a vehicle wheel, characterised by the fact that it comprises a first rigid screen which can be fixed for rotation with one of the said members which is rotatable

with respect to the other, which first screen carries a reference element fixed for rotation therewith and provided with a ring of depressions in a regular succession, a rigid second screen which can be fitted
5 onto the other of the said members and fixedly carrying a sensor disposed in a position such as to be disposed, in use, facing the said reference element, and an annular elastomeric sealing element carried by one of the said rigid screens and able to cooperate in use with the other
10 of the said screens to define between them and with the said members on which the screens are fitted, a fluid tight closed chamber housing the said sensor and the said reference element.

15 For a better understanding of the invention there is now given a non-limitative description of various embodiments, with reference to the attached drawings, in which:

20 Figure 1 illustrates a support bearing for a vehicle wheel, not illustrated, provided with a sealing assembly according to the invention;

Figure 2 illustrates on an enlarged scale and in sectioned side view a detail of the sealing assembly
25 according to the invention mounted on the bearing of Figure 1; and

Figures 3 and 4 illustrate two possible variants of the sealing assembly of Figure 2.

With reference to Figures 1 and 2 a rolling element bearing of known type able to support a wheel, not illustrated, of the vehicle, also known and not illustrated for simplicity, is generally indicated with the reference numeral 1; the bearing 1 comprises an outer ring 2, an inner ring 3 and a plurality of rolling bodies 4 grouped in two adjacent rings and interposed between the rings 2 and 3 to render these relatively rotatable with respect to one another with low friction; one of the rings, in this case the outer ring 2, is provided with an attachment flange 5 for the said vehicle wheel, and the annular space between these, in which the rolling element bearings are housed, is closed from the outside by a seal 6 of known type and by a sealing assembly 7 of double screen type illustrated only schematically in Figure 1 and in detail in Figure 2, disposed on the side opposite the flange 5 and including a first rigid screen 8 preferably made in sheet metal and fitted onto the ring 2, fixed to it externally, and a second rigid screen 9, also preferably made of sheet metal, which is fitted onto the ring 3; in particular this latter, which is preferably made from a pair of adjacent half-rings, is provided on the side opposite the flange 5 with a

portion 10 for mounting one of the screens 8 and 9, in particular for the screen 9, which projects axially out from the outer ring 2, whilst this latter is provided on its outer side surface 11 with an annular groove 12 for receiving the screen 8; this, according to the invention, is constituted by a cup-shape sheet metal element having an end rim 13 swaged into the annular groove 12, whilst the screen 9 is closely fitted onto the mounting portion 10 of the inner ring 3 within the said cup-shape element 8 opposite a through hole 14 passing through this latter and of a diameter such as to allow the screen 9 to pass through it; the cup-shape screen element 8 includes a cylindrical side wall 15 fitted onto the surface 11 of the ring 2 coaxially therewith, and a bottom wall 16 provided centrally with a hole 14, which is coaxial with the wall 15 and with the rest of the screen 8; according to the invention it carries, for rotation therewith, a ferromagnetic element provided in a ring with a regular succession of depressions 18, which is constituted by a cylindrical internally toothed ring 19 fitted against an inner surface 20 of the side wall 15 of the cup-shape element 8 coaxial therewith, which ring 19 is, in use, as is illustrated in Figure 2, able to be clamped between the bottom wall 16 of the cup-shape element 8 and an end face 21 of the radially outer member of those between which the sealing assembly 7 is interposed, in this case

the ring 2.

The screen 9 is constituted by an annular sheet metal element shaped in radial section with a substantially L-shape profile which is mountable on the portion 10 of the ring 3, projecting with respect to the face 21, and which is provided, according to the invention with a sensor 22 of known type (for example a magnetic sensor) fixed for rotation therewith and disposed in a position such as to be disposed, in use, facing the reference element 19, (for example made of ferromagnetic material); this, in substance, defines a phonic wheel of known type and, being fitted by the screen 8 to a rotating member such as the ring 2, permits in use the detection, by the sensor 22, of the angular velocity of the ring 2 and, in this case, of the wheel fixed to it securely through the flange 5 in that, because of the relative motion between the rings 2 and 3, the passage of the teeth and the voids constituted by the interdental spaces 18 in front of the sensor 22, usually constituted by a simple electromagnet, makes it possible to induce in this a magnetic field variation because of the variations in the air gap, such as to generate a pulse signal which the sensor 22 can then transmit in a known way, not illustrated for simplicity, for example through appropriate wires passing out through the sealing assembly 7 through the screen 9

and the hole 14, to a central control unit, for example of an ABS installation. The sealing assembly 7 according to the invention finally includes an elastomeric annular sealing element 23 carried by one of the screens 8 and 9, but preferably by that provided with the sensor 22 and therefore, in the illustrated example, by the screen 9, which is able to cooperate in use with the other screen (screen 8) to define between them and with the members on which the screens 8 and 9 are fitted (rings 2 and 3) an annular chamber 24 closed in a fluid tight sealing manner by the elastomeric element 23 and housing, according to the invention, both the sensor 22 and the reference element 19 cooperating with it. In the embodiment illustrated the element or screen 8 is provided on its bottom wall 16, in correspondence with the hole 14, with an annular indentation 26 the concavity of which faces towards the interior of the element 8 itself; the elastomeric sealing element 23 is constituted by an annular lip shaped, in radial section, with a substantially V-shape which projects from an outer peripheral rim 27 of the screen 9 and which cooperates by sliding, in use, with the indentation 26 within the concavity thereof, as well as with the wall portion 16 immediately adjacent to the hole 14 so as to exert a dual sealing action, both radial and axial, against the exterior to close the chamber 24 and consequently protect

not only the rolling bodies 4 as in traditional sealing assemblies, but also, according to the invention, the sensor 22 and associated phonic element 19 with its depressions 18.

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Making reference now to Figure 3, where similar or identical details to those already described are indicated for simplicity with the same reference numerals, the bearing 1 or any pair of relatively
10 rotatable members such as the rings 2 and 3 the speed of rotation of one of which it is desired to measure, can be provided in place of the sealing assembly 7 with its variant 7a which is entirely similar except for the different form of the screen 9 and the absence of the
15 indentation 26 on the screen 8; in this sealing assembly, in fact, the screen 9 is constituted by an annular sheet metal element which is substantially U-shape in radial section, disposed parallel to the axis of the element 8a and defined by a pair of concentric sleeves 30 and 31
20 connected integrally by a common terminal flange portion 32; the sleeve 30 is able to allow the screen 9 to be fitted on the ring 3 projecting with respect to the face 21a within the element 8, whilst the sleeve 31 carries the sensor 22 externally and projecting perpendicularly,
25 on the side opposite that facing towards the inner sleeve 30, and is provided securely with an annular elastomeric

sealing element 34 which includes a lip 35 which in use can cooperate by sliding over the surface 21, and an annular protuberance 36 extending radially over the exterior of the sleeve 31 and disposed flush with the bottom wall 16 of the element 8 close to a rim 37 of the through hole 14 in such a way as to define a labyrinth seal with the rim 37. In this variant there is thus left, between the sleeves 30 and 31, within the sealing assembly 7a, a large chamber isolated by the lip 35 and which can be utilised for reserves of lubrication grease, as well as the chamber 24, also sealingly closed in a fluid tight manner like the above, housing the sensor 21 and phonic element 19.

Finally, making reference to Figure 4, there is illustrated therein a further variant 7b of the sealing assembly 7, again illustrated, for simplicity, on a bearing 1b, illustrated only in part, which differs from the bearing 1 only by the fact that the ring fixed to the wheel is now the inner ring 3 (typical case of bearings for the driving wheels of vehicles) which obviously is provided in a known manner, in place of the outer ring 2, with the flange 5 which however is disposed on the opposite side from the sealing assembly 7b; similar or identical details to those already described are indicated with the same reference numerals; in

particular, in this case the screen provided with the sensor 22 is constituted by a cup-shape element 8b identical to the element 8 of the sealing assembly 7a except for the fact that it is shaped in such a way as to be provided with an inwardly projecting sensor 22 on the inner surface 20 of the side wall 15 and with an annular sealing element 40 fixed on the rim 37 of the through hole 14 in the bottom wall 16 and projecting inwardly therefrom; the sealing element 40 is provided with a pair of substantially parallel radial annular lips 41 extending towards the radially inner screen 9b; this is constituted by an annular sheet metal element of substantially U-shape in radial section disposed parallel to the axis of the cup-shape element 8b and defined by a pair of concentric sleeves 42 and 43 connected integrally by a common terminal flange portion 44; the sleeve 42 allows the screen 9b to be fitted onto the projecting portion 10 of the rotating ring 3, projecting with respect to the face 21 and with respect to the interior of the cup-shape element 8b; the sleeve 43 on the other hand defines the reference element cooperating with the sensor 22 being integrally formed with the rest of the screen 9b, which is likewise made of sheet metal, and provided with a plurality of parallel slots 46 formed in a ring defining the depressions 18; the flange portion 44 finally includes an inclined, substantially frustoccnical

part 45 having its narrow end facing outwardly of the chamber 24, defined between the screens 8b and 9b and the rings 2 and 3, on which the lip 41 of the elastomeric element 40 slide for fluid tight sealing of the chamber

5 24.

From what has been described the advantages connected with the sealing assembly according to the invention and with the support bearing for wheels provided therewith will be evident; substantially within the same dimensions required for a normal sealing assembly, in fact, a system for detecting the relative angular velocity of the members between which the sealing assembly is placed has been successfully positioned, all with a saving of weight due to the reduction of the number of components with respect to known rotational velocity detection systems, with respect to this, and, especially in the case of applications on vehicle wheels, there is total protection from external contaminants both of the sensor and of the phonic element so that the measurement system becomes of high reliability and no longer requires frequent maintenance; finally, in the case of sealing assemblies directly mounted on a bearing, the support unit thus obtained permits the angular velocity of the member supported by it to be detected in use with extreme precision compared to detection systems in use today in

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that the sensor, rather than being mounted on the vehicle
in a suitable position which is determined upon assembly
thereof, with all the possible positioning errors of an
operation performed on the assembly line, or by artisans
5 for systems which are not part of the first installation,
are mounted with high precision already on the bearing,
upon positioning of the sealing assembly.

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CLAIMS

1. A sealing assembly for interposition between two relatively rotatable members, in particular between the rings of a rolling element bearing for the support of a vehicle wheel, characterised by the fact that it comprises a first rigid screen which can be fixed for rotation with one of the said members which is rotatable with respect to the other, which first screen carries a reference element fixed for rotation therewith and provided with a regular succession of depressions in a ring, a rigid second screen which can be fitted onto the other of the said members and fixedly carrying a sensor disposed in a position such as to be disposed, in use, facing the said reference element, and an annular elastomeric sealing element carried by one of the said rigid screens and able to cooperate in use with the other of the said screens to define between them and with the said members on which the screens are fitted a fluid tight sealed chamber housing the said sensor and the said reference element.

2. A sealing assembly according to Claim 1, characterised by the fact that the said annular elastomeric sealing element is carried by the said second screen, together with the said sensor.

3. A sealing assembly according to Claim 1 or Claim 2, characterised by the fact that one of the said rigid screens is constituted by a cup-shape element having a cylindrical side wall fitted onto a first of the said members coaxially thereof and fixed securely thereto, radially externally with respect to the other, and a bottom wall provided with a central through hole having a diameter such as to allow the other said screen to pass through it.

4. A sealing assembly according to Claim 3, characterised by the fact that the said first screen is constituted by the said cup-shape element, and by the fact that the said reference element is constituted by an internally toothed cylindrical ring fitted against an inner surface of the said lateral wall of the cup-shape element coaxially therewith, the said internally toothed ring being able in use to be gripped between the said bottom wall of the cup-shape element and an end face of the said first member.

5. A sealing assembly according to Claim 4, characterised by the fact that the said second screen is constituted by an annular element having a substantially L-shape in radial section, which is mountable on a second

of the said members projecting from the said end face of the said first member and into the interior of the said cup-shape element, this latter being provided on the said bottom wall around the said central through hole with an annular indentation the concavity of which faces towards the interior of the cup-shape element; the said elastomeric sealing element being constituted by an annular lip having a substantially V-shape radial section projecting from an outer peripheral rim of the said second screen and cooperating, in use, by sliding on the said concavity of the said indentation of the said cup-shape element.

6. A sealing assembly according to Claim 4, characterised by the fact that the said second screen is constituted by an annular element having a substantially U-shape radial section disposed parallel to the axis of the said cup-shape element and defined by a pair of concentric sleeves connected integrally by a common terminal flange portion, a first sleeve being able to allow fitting of the said second screen on a second of the said members, projecting with respect to the said end face of the said first member and within the interior of the said cup-shape element, and a second sleeve carrying the said sensor projecting perpendicularly outwardly and being provided fixedly with the said annular sealing

element, which includes a lip able in use to cooperate by sliding on the said end face of the first member, and an annular protuberance extending radially over the exterior of the said second sleeve of the second screen and

5 disposed flush with the said bottom wall of the cup-shape element close to a rim of the said through hole of this latter in such a way as to define a labyrinth seal with the said rim.

10 7. A sealing assembly according to Claim 3, characterised by the fact that the said second screen is constituted by the said cup-shape element, which is provided with the said sensor projecting inwardly from the said lateral wall and with the said annular sealing
15 element fixed so as to project inwardly from the rim of the said through hole in the said bottom wall, and by the fact that the said first screen is constituted by an annular element of sheet metal having a substantially U-shape radial section disposed parallel to the axis of
20 the said cup-shape element and defined by a pair of concentric sleeves integrally connected by a common terminal flange portion, a first sleeve being able to allow the said first screen to be fitted onto a second of the said members projecting with respect to the said end
25 face of the said first member and into the interior of the said cup-shape element, and a second sleeve defining

the said ferromagnetic element being provided with a plurality of parallel slots defining the said depressions; the said flange portion of the first screen including an inclined part on which the said elastomeric sealing element slides.

8. A bearing for supporting the wheel of a vehicle and able to permit measurement of the speed of rotation thereof, of the type comprising an outer ring , an inner ring and a plurality of rolling bodies interposed between the said rings to render them relatively rotatable with respect to one another with low friction, in which one of the said rings is provided with an attachment flange for the said wheel, characterised by the fact that it includes a sealing assembly according to any of Claims from 1 to 7 disposed on the side opposite the said flange and having the said first screen thereof fitted onto that ring of the said bearing provided with the attachment flange for the wheel and the said second screen fitted onto the other of the said rings, the inner ring of the said bearing being provided, on the side opposite the said wheel attachment flange, with a mounting portion for receiving one of the said screens extending axially and projecting out from the said outer ring, and this latter being provided on its outer lateral surface with an annular groove for receiving the other of the said

screens of the sealing assembly.

9. A bearing according to Claim 8, characterised by the fact that the said screen of the sealing assembly
5 fitted to the said outer ring is constituted by a sheet metal cup-shape element having a rim swaged into the said annular groove, whilst the other said screen is fitted into the said mounting portion of the inner ring within the said cup-shape element.

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10. A sealing assembly substantially as hereinbefore described with reference to, and as illustrated in, Figures 1 and 2 or Figure 3, or Figure 4 of the accompanying drawings.

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11. The combination of a bearing and sealing assembly therefor, the combination being substantially as hereinbefore described with reference to, and as illustrated in, Figures 1 and 2, or Figure 3, or Figure 4, of the
20 accompanying drawings.

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DERWENT-WEEK: 199145

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TITLE: Sealing assembly, esp. for
vehicle wheel bearing rings
exerts sealing action on bearing
ring and allows detection of
angular velocity of wheel using
magnetic sensor

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DE 3819619 A	February 2, 1989	DE
FR 2618516 A	January 27, 1989	FR
ES 2009983 A	October 16, 1989	ES
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IT 1211239 B	October 12, 1989	IT

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DE 3819619A	N/A	1988DE-3819619	June 9, 1988
ES 2009983A	N/A	1988ES-002996	July 20, 1988

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CIPS	F16C33/78 20060101
CIPS	G01P3/44 20060101

ABSTRACTED-PUB-NO: GB 2207470 A**BASIC-ABSTRACT:**

The sealing assembly has a rigid screen which can be fixed for rotation with one nail member which is rotatable with respect to the other. The screen carries a reference device fixed for rotation with it. A regular succession of depressions are formed in a ring. A rigid second screen can be fitted onto the other member and fixedly carries a sensor disposed in a position such as to be disposed, in use, facing the reference device.

An annular elastomeric sealing member is carried

by one of the rigid screens and able to cooperate in use with the other screens to define between them. The screens are fitted on the members fitted with a fluid tight sealed chamber housing the sensor and the reference device.

ADVANTAGE - Reliable.

CHOSEN-DRAWING: Dwg.2/4

TITLE-TERMS: SEAL ASSEMBLE VEHICLE WHEEL
BEARING RING EXERT ACTION
ALLOW DETECT ANGULAR
VELOCITY MAGNETIC SENSE

ADDL-INDEXING-TERMS: ABS ANTILOCK BRAKE SYSTEM

DERWENT-CLASS: Q11 Q62 Q65 S02 X22

EPI-CODES: S02-G01B; X22-C01;